E. EMISSIONS IMPACT ESTIMATES FOR POTENTIAL IVHS PROJECTS

APPENDIX E

BI-STATE ST. LOUIS AREA IVHS PLANNING STUDY

Emissions Impact Estimates for Potential IVHS Projects

I. Introduction

The following report provides emission estimates for current and future traffic volumes along the interstate highway system in the bi-state St. Louis area and includes an analysis of the potential impact that IVHS measures could have on these pollutant emissions. Estimates are provided for various segments of the Interstate system which are presently experiencing significant travel delays. These segments are listed below and illustrated in Exhibit 1.

- Interstate 44 (EB); From Bowles Ave. to Route 61/67 (A.M. Peak)
- Interstate 55 (NB); From Meramec Bottom to Railroad Overpass (A.M. Peak)
- Interstate 55/70 (WB) From North B&O to West end of Poplar Street Bridge (AM Peak)
- Interstate 64 (EB); From Interstate 170 to Bellevue (A.M. Peak)
- Interstate 64 (WB); From Oakland to Interstate 170 (A.M. Peak)
- Interstate 64 (EB); From interstate 170 to State Line (P.M. Peak)
- Interstate 64 a From State Line to Interstate 170 (P.M. Peak)
- Interstate 70 (EB); From Cave Springs to Earth City (A.M. Peak)
- I-70 Exit ramp (EB/SB) From I-70 to I-270 (AM Peak)
- Interstate 70 (EB); From East Grand to Broadway (P.M. Peak)
- Interstate 70 (WB); From Union to Jennings Sta. (P.M. Peak)
- Interstate 70 (WB); From Earth City to Fairgrounds (P.M. Peak)
- Interstate 270 (EB/NB); From Interstate 64/40 to Route AB (A.M. Peak)
- Interstate 270 (EB); From Hanley/Graham to Route N (P.M. Peak)
- I-270 Exit ramp (NB/WB) From I-270 to I-70 (PM Peak)

II. Methodology

Traffic count information for the above segments, as well as others, was collected from the Missouri Highway & Transportation Department (MHTD) and the Illinois Department of Transportation (IDOT). These particular segments were chosen because their existing travel speeds are less than 45 mph during peak period(s). This travel speed data was also obtained from recent MHTD and IDOT studies of the freeway system.

Emission calculations were based upon the two-hour peak volume, the relative travel speed, the length of the segment and the appropriate emission factors for HC, CO and NO. The formula that was used was obtained from the Federal Highway Administration's, "A Method for Estimating Fuel Consumption and Vehicle Emissions on Urban Arterials and Networks". The emission factors were provided by the East-West Gateway Coordinating Council as generated from the MOBILES computer program. These emission factors correlate to the measured travel speed of a corridor.

Using this information, two different scenarios were examined. First, the current emissions were calculated and compared to estimates based on increased speed increments of 5 and 10 miles/hour. For the purposes of these calculations, the two-hour peak volumes were assumed to remain constant with the increase in speeds.

Secondly, Annual Growth Rates were provided by MHTD for the interstate system based upon 1992-1993 data. The AGR was then used to determine both ADT and peak hour volumes for the year 2013 (20 years), from which emission estimates were calculated. Travel speeds were assumed to remain constant for these calculations, although speeds would generally be lower due to increased volumes.

For both conditions, increased speeds would result in reduced emissions. An increase in travel speeds could be achieved by "flattening out the peaks" during peak traffic hours through traffic management strategies proposed for the IVHS system. These measures would presumably lessen the number and magnitude of traffic surges, thereby preventing congestion that might result from those conditions,

III. Emissions Estimates

Tables 1 and 2 illustrate the emission estimates for the previously mentioned segments. These results show comparisons of current emission estimates to those with increased speed increments and projected 20 year traffic growth estimates.

These calculations indicate that the opportunity exists to reduce both present-day and future auto emissions through improved traffic management The potential present-day benefits which could be derived from a five or ten-mile per hour increase in peak hour travel speeds are illustrated in Table 1. The second table illustrates the extent to which emissions could increase over the next 20 years due to projected traffic growth. The degree to which travel speeds could be increased through IVHS measures to offset these added emissions offers another potential benefit from this program.

It should be noted that the emission estimates contained in this memorandum are not intended to represent accurate pollutant calculations for the St. Louis area or its freeway system. Rather, the potential impacts are intended to illustrate the order of magnitude that may be realized through the implementation of IVHS strategies.

IV. Summary and Conclusions

By summarizing the attached tables, as shown in Table 3, it can be seen that the selected links would generate roughly 470,000 Ibs/year of HC, 3.68 million Ibs/year of CO and 625,000 Ibs/year of NOx. These totals may be expected to increase by 315,000, 2.42 million and 390,000 Ibs/year, respectively, within the next 20 years without any improvements, although the increase in pollutants would likely be even greater since higher volumes would result in even slower travel speeds. These additional emissions would represent increases of approximately 65%.

As shown, the implementation of IVHS technologies may be expected to increase peak hour travel speeds by as much as five or ten miles per hour. These changes in travel speeds would result in emissions savings of 60 to 100 thousand Ibs/year of HC, 575 to 955 thousand Ibs/year of CO, and an increase of 780 to 10,600 Ibs/year of NOx. Emissions of HC and CO would both be reduced by 12 to 25%, but NOx emissions would increase from 0 to 2%.

As previously mentioned, these totals do not represent pollutant calculations for the entire St. Louis area or its freeway system. However, it may be reasoned that HC and CO emissions could be reduced by 12 to 25% along those sections of freeway on which IVHS measures are applied, while NO, emissions would remain relatively unchanged. An equivalent level of improvements might also be assumed for the 20 year forecasts, thereby offsetting, to some degree, those emissions increases that would be caused by higher traffic volumes.

TABLE 1

POTENTIAL PRESENT-DAY EMISSION REDUCTIONS ALONG THE INTERSTATE HIGHWAY SYSTEM WHICH COULD RESULT PROM INCREASED TRAVEL SPEEDS

Corridor/Location: I-44 (EB); Bowles Avenue to Route 61/67 (AM)

lbs/day lbs/yr.	Existing Speed: 34.2 mph			Projected Speed: 39.2 mph			Projected Speed: 44.2 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	121	866	191	107	769	190	98	706	195
Annually	31,460	225,160	49,660	27,820	199,940	49,400	25,480	183,560	50,700

Corridor/Location: I-55 (NB); Meramec Bottom to Railroad Overpass (AM)

lbs/day lbs/yr.	Existing Speed: 25.8 mph			Projected Speed: 30.8 mph			Projected Speed: 35.8 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	96	752	124	85	635	125	76	555	126
Annually	24,960	195,520	32,240	22,100	165,100	32,500	19,760	144,300	32,760

Corridor/Location: I-55/70 (WB) North End B&O to West end of Poolar Street Bridee (AM)

lbs/day lbs/yr.	Existing Speed: 17.5 mph			Projected Speed: 22.5 mph			Projected Speed: 27.5 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	159	1,313	158	130	1,052	153	107	868	152
Annually	38,780	41,340	341,380	141,080	33,800	273,526	27,820	225,680	39,520

Corridor/Location: I-64 (EB): I-170 to Bellevue (AM)

lbs/day lbs/yr.	Existing Speed: 20 mph			Projected Speed: 25 mph			Projected Speed: 30 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	88	734	96	75	593	95	66	498	95
Annually	22,880	190,840	24,960	19,500	154,180	24,700	17,160	129,480	24,700

TABLE 1 (CONTINUED)

Corridor/Location: I-64 (WB): Oakland to I-170 (AM)									
lbs/day lbs/yr.	Existing Speed: 29.5 mph			Projected Speed: 34.5 mph			Projected Speed: 39.5 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	66	500	94	58	433	95	54	387	96
Annually	17,160	130,000	24,440	15,080	112,580	24,700	14,040	100,620	24,960

Corridor/Location: I-64 (EB): I-170 to State Line (PM)									
lbs/day lbs/yr.	Existing Speed: 23.7 mph			Projected Speed: 28.7 mph			Projected Speed: 33.7 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	299	2,381	364	261	1,982	363	233	1,707	365
Annually	77,740	619,060	94,640	67,860	515,320	94,380	60,580	443,820	94,900

Corridor/Location: I-64 (WB): State Line to I-170 (PM)									
lbs/day lbs/yr.	Existing Speed: 35.4 mph			Projected Speed: 40.4 mph			Projected Speed: 45.4 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	290	2,190	472	264	1,894	480	243	1,752	498
Annually	75,400	569,400	122,720	68,640	492,440	124,800	63,180	455,520	129,480

Corridor/Location: I-70 (EBI: Cave Sorines to Earth City (AM)									
lbs/day lbs/yr.	Existing Speed: 24.1 mph			Projected Speed: 29.1 mph			Projected Speed: 34.1 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	292	2,321	360	256	1,938	360	228	1,673	362
Annually	75,920	603,460	93,600	66,560	503,880	93,600	59,280	434,980	94,120

TABLE 1 (CONTINUED)

Corridor/Location: I-70 Exit Ramp: I-70 to I-270 (EB/SB) (AM)									
lbs/day lbs/yr.	Existing Speed: 17.9 mph			Projected Speed: 22.9 mph			Projected Speed: 27.9 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	41	342	42	34	274	41	30	227	40
Annually	10,660	88,920	10,920	8,840	71,240	10,660	7,800	59,020	10,400

Corridor/Location: I-70 (EB): East Grand to Broadway (PM)									
lbs/day lbs/yr.	Existing Speed: 36.6 mph			Projected Speed: 41.6 mph			Projected Speed: 46.6 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	62	446	103	56	403	105	52	375	109
Annually	16,120	115,960	26,780	14,560	104,780	27,300	13,520	97,500	28,340

Corridor/Location: I-70 (WB): Union to Jennings Sta. (PM)									
lbs/day lbs/yr.	Existing Speed: 34.1 mph			Projected Speed: 39.1 mph			Projected Speed: 44.1 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	52	384	83	48	342	84	44	314	87
Annually	13,520	99,840	21,580	12,480	88,920	21,840	11,440	81,640	22,620

Corridor/Location: I-70 (WB): Earth City to Fairgrounds (overpass) (PM)									
lbs/day lbs/yr.	Existing Speed: 23.4 mph			Projected Speed: 28.4 mph			Projected Speed: 33.4 mph		
	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	144	1,150	174	125	955	173	112	821	174
Annually	37,440	299,000	45,240	32,500	248,300	44,980	29,120	213,460	45,240

TABLE 1 (CONTINUED)

Corridor/Location: I-270 (EB/NB): I-64/40 to Route AB (AM)									
lbs/day	Existing Speed: 26.2 mph			Projected Speed: 31.2 mph			Projected Speed: 36.2 mph		
lbs/yr.	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	64	498	84	57	422	84	51	369	85
Annually	16,640	129,480	21,840	14,820	109,720	21,840	13,260	95,940	22,100

Corridor/Location: I-270 (EB): Hanley/Graham to Route N (PM)									
lbs/day	Existing Speed: 34.5 mph			Projected Speed: 39.5 mph			Projected Speed: 44.5 mph		
lbs/yr.	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	17	117	26	14	104	26	13	96	27
Annually	4,420	30,420	6,760	3,640	27,040	6,760	3,380	24,960	7,020

Corridor/Location: I-270 Exit Ramp: I-270 to I-70 (NB/WB) (PM)									
lbs/day	Existing Speed: 34.6 mph			Projected Speed: 39.6 mph			Projected Speed: 44.6 mph		
lbs/yr.	HC	CO	NO	HC	CO	NO	HC	CO	NO
Daily	20	149	33	18	133	33	17	122	34
Annually	5,200	38,740	8,580	4,680	34,580	8,580	4,420	31,720	8,840

TABLE 2
POTENTIAL FUTURE EMISSION INCREASES ALONG THE INTERSTATE HIGHWAY SYSTEM
WHICH COULD RESULT FROM THE EFFECT
OF PROJECTED 20-YEAR TRAFFIC GROWTH RATES

Corridor/Location: I-44 (EB); Bowles Avenue to Route 61/67 (AM)									
Travel Speed: 34.2 mph				Length of Section: 3.77 miles					
	Current			20 Years			Net Difference		
	ADT = 48,140			ADT = 80,233			ADT = 32,093		
	Peak Volume = 10,428			Peak Volume = 17,380			Peak Volume = 6,952		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	121	866	191	202	1,443	318	82	577	127
Peak Annually	31,460	225,160	49,660	52,520	375,180	82,680	21,060	150,020	33,020

Corridor/Location: I-55 (NB); Meramec Bottom to Railroad Overpass (AM)									
Travel Speed: 25.8 mph				Length of Section: 2.9 miles					
	Current			20 Years			Net Difference		
	ADT = 41,942			ADT = 69,903			ADT = 27,961		
	Peak Volume = 9,075			Peak Volume = 15,125			Peak Volume = 6,050		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	96	752	124	161	1,253	207	65	501	83
Peak Annually	24,960	195,520	32,240	41,860	325,780	53,820	16,900	130,260	21,580

Corridor/Location: I-55/70 (WB); North B&O to West end Poplar Street Bridge (AM)									
Travel Speed: 17.5 mph				Length of Section: 3.48 miles					
	Current			20 Years			Net Difference		
	ADT = 56,000			ADT = 93,333			ADT = 37,333		
	Peak Volume = 9,279			Peak Volume = 15,465			Peak Volume = 6,186		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	159	1,313	158	265	2,189	263	106	876	105
Peak Annually	41,340	341,380	41,080	68,900	569,140	68,380	27,560	227,760	27,300

TABLE 2 (CONTINUED)

Corridor/Location: I-64 I-170 to Bellevue (AM)									
Length of Section: 1.71 mileS				Travel Speed: 20 mph					
	Current			20 Years			Net Difference		
	ADT = 65,706			ADT = 109,510			ADT = 43,804		
	Peak Volume = 11,779			Peak Volume = 19,632			Peak Volume = 7,853		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	88	734	96	147	1,224	160	59	490	64
Peak Annually	22,880	190,840	24,960	38,220	1,318,240	41,600	15,340	127,400	16,640

Corridor/Location: I-64 (WB); Oakland to I-170 (AM)									
Travel Speed: 29.5 mph				Length of Section: 2.37 miles					
	Current			20 Years			Net Difference		
	ADT = 66,625			ADT = 111,042			ADT = 44,417		
	Peak Volume = 8,397			Peak Volume = 13,995			Peak Volume = 5,598		
(Ibs/day) (Ibs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	66	500	94	110	833	156	44	333	62
Peak Annually	17,160	130,000	24,440	28,600	216,580	40,560	11,440	86,580	16,120

Corridor/Location: I-64 (EB); I-170 to State Line (PM)									
Travel Speed 23.7 mph				Length of Section: 9.05 miles					
	Current			20 Years			Net Difference		
	ADT = 65,875			ADT = 109,792			ADT = 43,917		
	Peak Volume = 8,489			Peak Volume = 14,148			Peak Volume = 5,659		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	299	2,381	364	498	3,696	606	307	1,315	242
Peak Annually	77,740	619,060	94,640	129,480	1,031,940	157,560	51,740	412,880	62,920

TABLE 2 (CONTINUED)

Corridor/Location: I-64 (WB); State Line to I-170 IWBI: State Line to I-170 (PM)									
Travel Speed: 35.4 mph				Length of Section: 9.07 miles			Length of Section: 9.07 miles		
	Current			20 Years			Net Difference		
	ADT = 66,898			ADT = 111,497			ADT = 44,599		
	Peak Volume = 10,930			Peak Volume = 18,217			Peak Volume = 7,287		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	290	2,109	472	483	3,516	786	193	1,407	314
Peak Annually	75,400	569,400	122,720	125,580	914,160	204,360	50,180	344,760	81,640

Corridor/Location: I-70 (EB); Cave Springs to Earth City (AM)									
Travel Speed: 24.1 mph				Length of Section: 5.14 miles					
	Current			20 Years			Net Difference		
	ADT = 89,064			ADT = 148,440			ADT = 59,376		
	Peak Volume = 14,804			Peak Volume = 24,673			Peak Volume = 9,869		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	292	2,321	360	487	3,868	601	195	1547	241
Peak Annually	75,920	603,460	93,600	126,620	1,005,680	156,260	50,700	402,220	62,660

Corridor/Location I-70 Exit Ramp; I-70 to I-270 (EB/SB) (AM)									
Travel Speed: 17.9 mph				Length of Section: 1.46 miles					
	Current			20 Years			Net Difference		
	ADT =			ADT =			ADT =		
	Peak Volume = 5,863			Peak Volume = 9,772			Peak Volume = 3,909		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	41	342	42	69	570	69	28	228	27
Peak Annually	10,660	88,920	10,920	17,940	148,200	17,940	7,280	59,230	7,020

TABLE 2 (CONTINUED)

Corridor/Location: I-70 (EB); East Grand to Broadway (PM)									
Travel Speed: 36.6 mph				Length of Section: 2.47 miles					
	Current			20 Years			Net Difference		
	ADT = 65,987			ADT = 109,978			ADT = 43,991		
	Peak Volume = 8,727			Peak Volume = 14,535			Peak Volume = 5,808		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	62	446	103	103	743	172	41	297	69
Peak Annually	16,120	115,960	26,780	26,780	193,180	44,720	10,660	77,220	17,940

Corridor/Location: I-70 (WB); Union to Jennings Sta. (PM)									
Travel Speed: 34.1 mph				Length of Section: 1.51 miles					
	Current			20 Years			Net Difference		
	ADT = 66,633			ADT = 111,055			ADT = 44,422		
	Peak Volume = 11,564			Peak Volume = 19,273			Peak Volume = 7,709		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	52	384	83	87	640	138	35	256	55
Peak Annually	13,520	99,840	21,580	22,620	166,400	35,880	9,100	66,560	14,300

Corridor/Location: I-70 (WB); Earth City to Fairgrounds (PM)									
Travel Speed: 23.4 mph				Length of Section: 2.5 miles					
	Current			20 Years			Net Difference		
	ADT = 87,868			ADT = 146,447			ADT = 58,579		
	Peak Volume = 14,658			Peak Volume = 24,430			Peak Volume = 9,772		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	144	1,150	174	240	1,916	289	96	766	115
Peak Annually	37,440	299,000	45,240	62,400	498,160	75,140	24,960	199,160	29,900

TABLE 2 (CONTINUED)

Corridor/Location: I-270 (EB/NB): I-64/40 to Route AB (AM)									
Travel Speed: 262 mph				Length of Section:1.17 miles					
	Current			20 Years			Net Difference		
	ADT = 92,237			ADT = 153,726			ADT = 61,491		
	Peak Volume = 15,128			Peak Volume = 25,213			Peak Volume = 10,085		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	64	498	84	107	830	139	43	332	55
Peak Annually	16,640	129,480	21,840	27,820	215,800	36,140	11,180	186,320	14,300

Corridor/Location: I-270(EB); Hanley/Gaham to Route N (PM)									
Travel Speed: 34.5 mph				Length of Section: .97 miles					
	Current			20 Years			Net Difference		
	ADT = 27,221			ADT = 45,368			ADT= 18,147		
	Peak Volume = 5,533			Peak Volume = 9,222			Peak Volume = 3,669		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	17	117	26	28	195	43	11	78	17
				7,280	50,700	11,180	2,860	20,280	4,420

Corridor/Location: I-270 Exit Ramp; I-270 to I-70 (NB/WB) (PM)									
Travel Speed: 34.6 mph				Length of Section: 1.74 miles					
	Current			20 Years			Net Difference		
	ADT =			ADT =			ADT =		
	Peak Volume = 3,936			Peak Volume = 6,560			Peak Volume =2,624		
(lbs/day) (lbs/yr)	HC	CO	NO	HC	CO	NO	HC	CO	NO
Peak Daily	20	149	33	34	248	54	14	99	21
Peak Annually	5,200	38,740	8,580	8,840	64,480	14,040	3,640	25,740	5,460

TABLE 3

SUMMARY OF POLLUTANT EMISSIONS CALCULATIONS FOR
SELECTED FREEWAY SEGMENTS

	Total Emissions (Ib/yr)		Projected Change in Emissions from Existing Traffic Due to Increased Travel Speeds			
	With Existing Traffic	Estimated 20-year Increase (with projected traffic growth)	With a 5 mph Increase		With a 10 mph Increase	
HC	470,860	314,600	-57,980	(-12%)	100,620	(-21%)
CO	3,677,180	2,416,440	-575,640	(-16%)	-954,980	(-26%)
NOx	625,040	391,040	+780	(0%)	+10,660	(+2%)